

Benefit / Cost Ratio Calculation Method

$$1) \text{Benefit(Annual)} = \frac{CRF \times \sum_{s=0}^4 (N_s \times AC_s)}{Y}$$

- *CRF* : Crash reduction factor in each countermeasure
- *S* : Severity (0:PDO, 1:Minor Injury, 2:Injuey, 3:Severe Injury, 4:Fatal)
- *N_s* : Number of selected countermeasure related accident in severity levels
- *Y* : Crash data time period (Year)
- *AC_s* : Accident costs in severity levels

Severity	Accident Cost
Fatality (Death)	\$4,100,000
Severe Injury	\$208,000
Injury – Other Visible	\$53,000
Injury – Complaint of Pain	\$25,000
Property Damage Only	\$2,300

* These crash costs are based on level of severity taken from the National Safety Council's "Estimating the Cost of Unintentional Injuries, 2009" bulletin.

$$2) \text{Benefit(Life)} = \text{Benefit(Annual)} \times (P / A, i, n)$$

- (*P / A, i, n*) : Uniform series present worth factor to convert a series of uniform annual amounts to its present value

$$(P / A, i, n) = \frac{(1 + i)^n - 1}{i(1 + i)^n}$$

i : minimum attractive rate of return expressed as a decimal fraction (*i* = 0.04)
n : service life of improvement

3) Benefit / Cost Ratio (each countermeasure)

$$\text{Benefit / CostRatio} = \frac{\text{Benefit(Life)}}{\text{Cost}}$$

4) Total Benefit / Cost Ratio

$$\text{TotalBenefit / CostRatio} = \frac{\sum_{CM=1}^3 \text{Benefit(Life)}_{CM}}{\text{TotalprojectCost}}$$